

### REMARKS

The specification was objected to because of an informality. Paragraph [0023] has been replaced to correct the informality. Claims 3 and 5 were objected to under 37 CFR 1.75(c), as being improper dependent form for failing to further limit the subject matter of a previous claim. Claims 1 to 8 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 has been amended to correct a minor typographical error. The specification has been

Reconsideration of the application based on the following is respectfully requested

#### Claim Objections

Claims 3 and 5 were objected to under 37 CFR 1.75(c), as being improper dependent form for failing to further limit the subject matter of a previous claim.

Claims 3 and 5 have been rewritten in independent form and should now further limit the subject matter of the claims.

Withdrawal of the objection to claims 3 and 5 is respectfully requested.

#### Specification Objection and Claim Rejections

Claims 1 to 8 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Nitro compounds are organic compounds containing the monovalent radical NO<sub>2</sub> directly combined with carbon. See for example the attached definition from <http://encyclopedia.jrank.org> and U.S. Patent No. 4,517,393 at col. 3, lines 1 to 6 and throughout.

C-NO<sub>2</sub> was used as a generic identifier for these compounds, but the specification has now been clarified to state that the nitro compounds have a C-NO<sub>2</sub> bond as clear from the definition of nitro compounds.

Appl. No. 10/066,881  
Amdt. dated April 29, 2005  
Reply to Office Action of March 29, 2005

Withdrawal of the specification objection and rejection under 35 U.S.C. §112 is respectfully requested.

CONCLUSION

The present application is respectfully submitted as being in condition for allowance and applicants respectfully request such action.

Respectfully submitted,

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# NITRO COMPOUNDS

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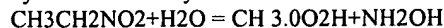
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**NITRO COMPOUNDS**, in organic chemistry, compounds containing the monovalent radical NO<sub>2</sub> directly combined with carbon. Aiphatic Nitro Compounds. The nitroparaffins may be obtained by the action of the alkyl iodides on silver nitrite (V. Meyer, Ann. 1874, 171, p. I et seq.). When methyl iodide is used, nitromethane is the sole product, but the higher homologues give more or less of the isomeric nitrous esters. Nitro-paraffins may also be obtained by the action of sodium nitrite on the a-halogen fatty acids, the a-nitro fatty acids first formed readily eliminating carbon dioxide (H. Kolbe, Jour. prak. Chem., . 1872 [2] 5, p. 427). Tertiary nitro compounds may also be obtained by the oxidation of the corresponding amino-, hydroxyl-amino-, and nitroso-hydrocarbons with monopersulphuric acid (E. Bamberger, Ber., 1903, 36, p. 385) :  
CNH<sub>2</sub>> CNHOHj > CNO> . CNO<sub>2</sub>.

The nitro compounds of the lower members of the paraffin SERIES cannot be prepared by the direct action of nitric acid on the hydrocarbons themselves, but, in the case of some of the higher members of the SERIES direct nitration is possible (M. Konowalow, Comptes rendus, 1892, 114, p. 26; Ber., 1895, 28, p. 1852; R. A. Worstall, Amer. Chem. Jour., 1898, 20, p. 202).

The nitro compounds are colourless, somewhat pleasant smelling liquids, which distil without decomposition and possess boiling points much higher than those of the isomeric nitrous esters. Reduction with acid-reducing agents gives amines. The primary and secondary nitro compounds (i.e. those containing the groupings CH<sub>2</sub>NO<sub>2</sub> and >CHNO<sub>2</sub>) form metallic derivatives; for example, sodium salts, which according to A. Hantzsch (Ber., 1899, 32, pp. 577 et seq.) are probably derived from the isomeric iso-nitro compounds R : NO(OH), and thus the nitro derivatives are to be looked upon as pseudo-acids. These sodium salts are crystalline solids which are readily soluble in water and are very explosive. Stannous chloride and hydrochloric acid reduce the nitroparaffins to 0-alkyl hydroxylamines, amines and some ammonia being simultaneously produced (V. Meyer, Ber., 1891, 24, p. 3530), whilst the primary nitro compounds on heating with hydrochloric acid yield HYDROXYLAMINE and an acid:



(V. Meyer, Ann., 1876, 180, p. 163). When reduced by the Sabatier and Senderens' method (Comptes rendus, 1902, 135, p. 225) they are converted into amines, provided the temperature be kept at 150-200 C., a higher temperature leading to the formation of paraffins and ammonia. The hydrogen in the primary and secondary nitro compounds which is attached to the same carbon atom as the nitro group is readily replaced by bromine in alkaline solution. The reactions of the nitroparaffins with nitrous acid are very characteristic and have been used as a method for discriminating between the primary, secondary and tertiary alcohols (q.v.) (V. Meyer, Ann., 1875, 175, p. 93). The primary compounds form nitrolic acids of the type R.C(:NOH)NO, the secondary yield pseudo-nitrols of the type RR': C(NO)(NO<sub>2</sub>), whilst the tertiary nitro compounds are not acted upon by nitrous acid. The primary nitroparaffins combine with nitric OXIDE in the presence of sodium ethylate, to form nitroalkylisonitramines, RCH(NO<sub>2</sub>)N<sub>2</sub>O<sub>2</sub>H (W. Traube, Ann., 1898, 300, p 95).

Nitromethane, CH<sub>3</sub>NO<sub>2</sub>, is a colourless oil which boils at 101 C. Fuming sulphuric acid decomposes it into carbon monoxide and HYDROXYLAMINE. It combines with aromatic aldehydes in the presence of alcoholic potash to form addition products which are converted by acids into styrol derivatives (J. Thiele, Ber., 1899, 32, p. 1293). Nitroethane, C<sub>2</sub>H<sub>5</sub>NO<sub>2</sub>, is a colourless liquid which boils at 114 C.

Nitroform (trinitromethane),  $\text{CH}(\text{NO}_3)_3$ , is obtained in the form of its ammonium salt by the decomposition of trinitroacetonitrile with water (L. Schischkoff, Ann., 1857, 103, p. 364). It is a colourless crystalline solid which melts at 15 C. and has the properties of a strong acid. The potassium salt is formed by the action of potassium ethylate on tetranitromethane (A. Hantzsch, Ber., 1899, 32, p. 631). It is a deep yellow coloured solid, which is readily soluble in water. It explodes when heated. The silver salt, obtained by shaking an ether solution of nitroform with freshly prepared, slightly moist silver OXIDE, reacts with methyl iodide to form trinitroethane, a crystalline solid which melts at 56 C. Concentrated caustic potash decomposes the latter compound, forming the potassium salt of dinitroethane,  $\text{CH}_3\text{C}(\text{NO}_2)_2\text{K}$ . Tetranitromethane,  $\text{C}(\text{NO}_2)_4$ , obtained by adding nitroform to a hot mixture of nitric and sulphuric acids, is a crystalline solid which melts at 13 C. Chlorpicrin,  $\text{CCl}_3\text{NO}_2$ , is a liquid of suffocating odour obtained by the action of nitric acid and chloride of lime on many organic compounds. It boils at 112.

**Aromatic Nitro Compounds.** The aromatic nitro compounds are generally obtained by the direct action of nitric acid. Substitution takes place usually in the nucleus and only rarely in the side chain, and according to the conditions of the experiment and the nature of the compound acted upon, one or more nitro groups enter the molecule. The reaction is generally carried out in the presence of sulphuric acid, which is used to absorb the water formed during the process of nitration. Nitro compounds have also been prepared by the action of cuprous oxide on diazonium salts (T. Sandmeyer, Ber., 1887, 20, p. 1494); by the action of copper powder on the DOUBLE salt formed by the addition of potassium mercuric nitrite to diazonium nitrites; and by the oxidation of primary aromatic amines (E. Bamberger, Ber., 1893, 26, p. 496). The mono-nitro compounds are stable and distil without decomposition; they have a pale yellow colour and possess an agreeable odour. Most of the poly-nitro compounds are not volatile, but undergo decomposition on heating. The nitro group in the aromatic series is bound very firmly in the molecule and is not readily exchanged for other groups. Several different products may be obtained by the reduction of the aromatic nitro compounds, the substances formed in any particular case depending on the conditions of experiment. In acid solution, amines are obtained, in alkaline solution, azoxy, azo and hydrazo compounds, and in neutral solution hydroxylamino compounds. The electrolytic reduction of the aromatic nitro compounds gives rise to substituted hydroxylamines which are immediately transformed into aminophenols or amines.

For the nitrobenzenes see NITROBENZENE. Nitrotoluenes,

$\text{C}_6\text{H}_9(\text{CH}_3)(\text{NO}_2)_2$ . Three isomers exist, the ortho- and para-compounds being the CHIEF products of the direct nitration of toluene. They may be separated by fractional distillation. The ortho-compound melts at 10.5 C. and boils at 218 C., the para-compound melts at 54 C. and boils at 230 C. Meta-nitrotoluene (melting at 16 C.) is obtained by nitrating acetparatoluidide and then replacing the amino group by hydrogen.

Phenylnitromethane,  $\text{C}_6\text{H}_5\text{CH}_2\text{NO}_2$ , isomeric with the nitro-toluenes, is prepared by the action of benzyl chloride on silver nitrite. It is a colourless oily liquid which boils at 225-227 C., is somewhat soluble in water, and does not give a coloration with ferric chloride. It readily forms a sodium salt, from the aqueous solution of which on the addition of a MINERAL acid an isomeric solid form of the nitro compound (melting at 84 C.) is precipitated. This solid form gradually passes, on STANDING, into the oily variety. It is probably a hydroxy-compound, since it gives a red-brown colour with ferric chloride, reacts with phenyl isocyanate and with phosphorus pentachloride, and with benzoyl chloride yields dibenzhydroxamic acid,  $\text{C}_6\text{H}_5\text{CONHOCH}_2\text{C}_6\text{H}_5$ . Thus the solid form is probably to be represented as  $\text{C}_6\text{H}_5\text{CH}(\text{NO})\text{OH}$  or  $\text{C}_6\text{H}_5\text{CH}(\text{ON})\text{OH}$  (see further,

A. Hantzsch on Pseudo-acids, Ber., 1899, 32, p. 575, 1902, 35, pp. 210, 226, 1001, 1906, 39, pp. 139, 1073 et seq.).

The nitrolic acids,  $\text{RC}(\text{NOH})\text{NO}_2$ , may be prepared by the action of nitrous acid on the primary nitroparaffins; by the action of hydroxylamine on the dibromnitroparaffins; and by the action of nitrogen peroxide on the a-isonitroso fatty acids (G. Ponzio, Gazz., 1903, 33 (I), p. 508). They are colourless solids which are readily soluble in water and possess the character of weak acids. They are characterized by the deep red colour of their solutions in alkalis. When strongly heated they decompose, forming fatty acids, nitrogen peroxide and nitrogen. By passing hydrochloric acid gas into an ethereal solution of the acids, the nitro group is eliminated and the hydrochloride of an oximido-acid is obtained (A. Werner and H. Buss, Ber., 1895, 28, p. 1282):  $\text{CH}_3\text{C}(\text{NOH})\text{NO}_2 + 2\text{HCl} = \text{HNO}_2 + \text{CH}_3\text{C}(\text{NOH})\text{Cl} \cdot \text{HCl}$ .

When heated with water and mineral acids, the nitrolic acids are completely decomposed, yielding fatty acids and nitrous oxide.

A. Hantzsch and O. Graul (Ber. 1898, 31, p. 2854) described several series of salts of the nitrolic acids, with particular reference to ethylnitrolic acid. They discriminate between the red or erythro-salts, which are well crystallized, very explosive and unstable compounds, and which regenerate the colourless nitrolic acid on the addition of dilute MINERAL acids, and the leuco-salts, which are colourless salts obtained by warming the erythro-salts or by exposing them to direct sunlight. These salts cannot be converted either into the red salts or into the free acid. An intensely yellow acid salt is described, as is also a very unstable colourless salt which could not be examined further owing to its very labile nature. The following structural formulae are assigned to these compounds:

$\text{R} \cdot \text{CAN} \cdot \text{OH} \cdot \text{R} \cdot \text{O} \cdot \text{N}(\text{OK}) \cdot \text{O} \cdot \text{R} \cdot \text{O} \cdot \text{N} \cdot \text{O}_2\text{K}$

$\cdot \cdot \cdot \text{NO}_2 \sim \text{N}(\text{O}) \sim \text{NO}$

nitrolic acid; erythro-salt; leuco-salt.

The acid salts are obtained by the addition of one molecule of alkali to two molecules of the acid in concentrated alcoholic solution at a low temperature. They are unstable compounds which readily split into the red salt and the free acid on STANDING.

The pseudo-nitrols,  $\text{RR}'\text{C}(\text{NO})(\text{NO}_2)$ , may be obtained by the action of nitrous acid on the secondary nitroparaffins; by the action of silver nitrite on such bromnitrosoparaffins as contain the bromine and the nitroso group united to the same carbon atom (O. Piloty, Ber., 1902, 35, p. 3093); and by the action of nitrogen peroxide on ethereal solutions of ketoximes (R. Scholl, Ber., 1888, 21, p. 508; G. Born, Ber. 1896, 29, p. 93). They exhibit an intense blue colour when in the liquid condition or dissolved in alkali and possess a very SHARP smell. On oxidation with chromic acid they yield dinitrohydrocarbons, and on reduction with hydroxylamine (in alkaline solution) or with potassium sulphhydrate give ketoximes,  $\text{RR}'\text{C}(\text{NOH})$  (R. Scholl and K. Landsteiner, Ber., 1896, 29, p. 87).

$\text{RR}'\text{C}(\text{NO}) \cdot \text{NO}' \rightarrow \text{RR}'\text{C}(\text{NH} \cdot \text{OH})_2 \rightarrow \text{RR}'\text{C}(\text{NOH}) + \text{NH}_2\text{OH}$ .

Nitrosohydrocarbons have been prepared in the aliphatic series by the oxidation of the corresponding hydroxylamino compounds.

Nitroso-tertiary butane,  $(\text{CH}_3)_3\text{CNO}$ , is formed when the corresponding hydroxylamine is oxidized by sulphuric monoper acid (E.

Bamberger, Ber., 1903, 36, p. 686). A nitrosooctane  $(\text{CH}_2)_2\text{C}(\text{NO})[\text{CH}_2]_2\text{CH}(\text{CH}_3)_2$ , has been obtained by O. Piloty and O. RUFF (Ber., 1898, 31, p. 457) from nitro-di-isobutyl by reducing it to the corresponding hydroxylamino compound with aluminium amalgam and

oxidizing this with chromic acid mixture. It is a colourless solid which melts at 54 C. to a deep blue liquid. Numerous nitroso compounds are met with in the aromatic series.

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